

AMENDMENTS TO THE CLAIMS

Following is a listing of all claims in the present application, which listing supersedes all previously presented claims:

Listing of Claims:

1. (Currently Amended) A method for manufacturing a magnetic field detecting element consisting of having a soft magnetic core formed on a semiconductor substrate[[; a]], first and [[a]] second coils arranged on [[an]] upper and [[a]] lower [[parts]] surfaces of the soft magnetic core, respectively, the first and second coils each having a plurality of coil lines, respectively, the method comprising the steps of:

 forming a seed film [[of]] to a predetermined thickness on the semiconductor substrate;
 removing a portion of the seed film using a predetermined pattern so that [[a]] each of the plurality of [[the]] coil lines constituting the first coil that would be is subsequently formed on a remaining portion of the seed film may be partitioned each other is separated from the others;

 forming a first plating mold having a plurality of grooves that corresponds corresponding to the predetermined pattern, on an upper [[part]] portion of the seed film;

 forming [[a]] the plurality of [[the]] coil lines constituting the first coil by filling up metal in the groove plurality of grooves of the first plating mold with metal;

 forming [[a]] the soft magnetic core and the second coil on an upper [[part]] portion of the semiconductor substrate and on the remaining portion of the seed film where the first coil is formed; and

 cutting off [[four]] edges of the semiconductor substrate so that [[a]] each of the plurality of [[the]] coil lines partitioned separated by the predetermined pattern may be are insulated from each other.

2. (Currently Amended) The method ~~according to as claimed in~~ claim 1, wherein the step of removing ~~the portion of~~ the seed film further comprises: ~~the steps of~~ spreading ~~forming~~ a photoresist layer on an upper surface of the seed film; ~~forming a predetermined pattern that would be removed, by exposing and developing the photoresist to form the predetermined pattern;~~ and etching the seed film according to the predetermined pattern.

3. (Currently Amended) The method ~~according to as claimed in~~ claim 1, wherein metal is filled up in ~~the groove~~ filling the plurality of grooves of the first plating mold ~~by means of an~~ with metal comprises electric plating.

4. (Currently Amended) The method ~~according to as claimed in~~ claim 1, wherein the step of forming the soft magnetic core further comprises ~~the steps of~~:

~~performing planarization of~~ planarizing an upper surface of the semiconductor substrate on which the first coil is formed;

~~spreading an insulating film on [[an]]~~ the planarized upper surface of the semiconductor substrate ~~for which planarization has been performed;~~

~~spreading a soft magnetic material film on an upper [[part]]~~ surface of the insulating film; forming a ~~pattern of the soft magnetic core through exposing and developing processes after spreading a photoresist layer on the soft magnetic material film and exposing and developing the photoresist layer to form a pattern of the soft magnetic core;~~ and etching the soft magnetic material film according to the pattern.

5. (Currently Amended) The method ~~according to as claimed in~~ in claim 1, wherein the step of forming the soft magnetic core ~~further~~ comprises the steps of:

removing the first plating mold;

~~spreading forming~~ an insulating film [[at]] ~~to~~ a height ~~higher~~ ~~greater~~ than a height of the first coil[[,]] on an upper [[part]] surface of the semiconductor substrate from which the first plating mold has been removed;

spreading a soft magnetic material film on an upper [[part]] surface of the insulating film;

~~forming a soft magnetic core pattern through exposing and developing processes after spreading a photoresist layer on the soft magnetic material film and exposing and developing the photoresist layer to form a pattern of the soft magnetic core;~~ and

etching the soft magnetic material film according to the pattern.

6. (Currently Amended) A method for manufacturing a magnetic field detecting element ~~consisting of~~ ~~having~~ a soft magnetic core formed on a semiconductor substrate, and a first and [[a]] second coils respectively arranged on [[an]] upper and [[a]] lower [[parts]] surfaces of the soft magnetic core, [[and]] the first and second coils each having a plurality of coil lines, respectively, the method comprising the steps of:

forming a first seed film [[of]] ~~to~~ a predetermined thickness on the semiconductor substrate;

~~removing a portion of the first seed film using a predetermined first pattern so that [[a]] each of the plurality of coil lines constituting the first coil that would to be subsequently formed on the first seed film may be partitioned each other is separated from the others;~~

forming a first plating mold having a plurality of grooves that corresponds to the predetermined first pattern, on an upper [[part]] portion of the first seed film;

forming [[a]] the plurality of coil lines constituting the first coil by filling ~~up metal in the~~ ~~groove~~ the plurality of grooves of the first plating mold with metal;

forming [[a]] the soft magnetic core on the semiconductor substrate where the first coil is formed;

forming a second insulating film on the semiconductor substrate where the soft magnetic core is formed;

forming a second seed film on an upper surface of the second insulating film;

removing the second seed film using a predetermined second pattern so that a plurality of coil lines constituting the second coil ~~that would to be subsequently~~ formed on the second seed film ~~may be partitioned are separated from~~ each other;

forming a second plating mold having a plurality of grooves ~~that corresponds~~ corresponding to the second pattern, on an upper [[part]] portion of the second seed film;

forming a plurality of coil lines constituting the second coil by filling ~~up metal in the~~ ~~plurality of grooves~~ ~~groove~~ of the second plating mold with metal; and

cutting off edges on [[four]] sides of the semiconductor substrate so that [[a]] each of the plurality of [[the]] coil lines constituting the first and the second coils partitioned separated by the first and the second patterns ~~may be are~~ insulated from each other.

7. (Currently Amended) The method ~~according to as claimed in~~ claim 6, wherein ~~metal is filled up in~~ filling the plurality of grooves of the first and the second plating molds with metal comprises by means of an electric plating.

8. (Currently Amended) The method ~~according to as claimed in~~ in claim 6, wherein the step of forming the soft magnetic core further comprises ~~the steps of:~~

performing planarization of ~~planarizing~~ an upper surface of the semiconductor substrate on which the first coil is formed;

spreading a first insulating film on [[an]] ~~the planarized~~ upper surface of the semiconductor substrate ~~for which planarization has been performed~~;

spreading a soft magnetic material film on an upper [[part]] ~~portion~~ of the first insulating film;

forming a ~~soft magnetic core pattern through exposing and developing processes after~~ spreading a photoresist ~~layer~~ on the soft magnetic material film ~~and exposing and developing the photoresist layer to form a pattern of the soft magnetic core~~; and

etching the soft magnetic material film according to the pattern.

9. (Currently Amended) A method for manufacturing a magnetic field detecting element, ~~including the steps of:~~ comprising:

forming a well to a predetermined depth in a semiconductor substrate;

forming a first coil on an upper part of a the semiconductor substrate, the first coil being arranged within the well below an upper surface of the semiconductor substrate;

after forming a first insulating film on an upper portion of the first coil and forming a soft magnetic core on an upper [[part]] ~~portion~~ of the first coil with an insulating film intervened[[,]];

forming a second insulating film on an upper portion of the soft magnetic core; and

forming a second coil on an upper [[part]] ~~portion~~ of the soft magnetic core with another second insulating film intervened, the method comprising the step of:

~~after forming a well of a predetermined dept on the semiconductor substrate, arranging the first coil in an inside of the well lest the first coil should be projected to a surface of the semiconductor substrate.~~

10. (Currently Amended) A method for manufacturing a magnetic field detecting element, comprising the steps of:

preparing a semiconductor substrate;

forming a well [[of]] to a predetermined dept on depth in the semiconductor substrate;

forming a first coil consisting of a plurality of coil lines ~~in an inside of~~ within the well of the semiconductor substrate;

forming a first insulating film on an upper [[part]] portion of the semiconductor substrate including the well;

forming a soft magnetic core on an upper [[part]] portion of the first insulating film;

forming a second insulating film on an upper [[part]] portion of the first insulating film including the soft magnetic core; and

forming a second coil that corresponds corresponding to the first coil, on an upper [[part]] portion of the second insulating film.

11. (Currently Amended) The method ~~according to as claimed in~~ claim 10, wherein forming the well comprises etching inner sidewalls of the well to be is formed in such a way that the well has an inclined sidewall that is gradually inclined in its inside from [[its]] an upper [[part]] portion of the well to [[its]] a bottom by the etching process of the well.

12. (Currently Amended) The method ~~according to as claimed in~~ claim 10, wherein the step of forming the first coil further comprises the steps of:

forming a first seed film on a surface of the well;
forming a first plating mold having a plurality of grooves on the first seed film;
forming a plurality of coil lines constituting the first coil by filling the plurality of grooves up metal in each groove of the first plating mold with metal; and
removing the first plating mold and the first seed film under the first plating mold.

13. (Currently Amended) The method ~~according to as claimed in~~ claim 12, wherein filling the plurality of grooves metal is filled up in each groove of the first plating mold with metal by means of an comprises electric plating.

14. (Currently Amended) The method ~~according to as claimed in~~ claim 10, wherein the step of forming the second coil further comprises the steps of:

forming a via hole by etching the first and [[the]] second insulating films on both sides of the soft magnetic core;
forming a second seed film on an upper surface of the second insulating film [[on]] in which the via hole is formed;
forming a second plating mold having a plurality of grooves[[,]] on the second seed film;
forming a plurality of coil lines constituting a second coil by filling the plurality of grooves up metal in each groove of the second plating mold[[,]] with metal and connecting the first coil with the second coil through the via hole; and
removing the second plating mold and the second seed film under the second plating mold.

15. (Currently Amended) The method ~~according to as claimed in~~ claim 14, wherein filling the plurality of grooves metal is filled up in each groove of the second plating mold with metal by means of an comprises electric plating.

16. (Currently Amended) The method ~~according to as claimed in~~ claim 10, further comprising ~~the step of forming a protection film on the semiconductor substrate for protecting structures including the second coil to protect a structure formed thereon.~~

17. (Currently Amended) A magnetic field detecting element, comprising:
a semiconductor substrate;
a soft magnetic core formed on an upper [[part]] portion of the semiconductor substrate;
an insulating film positioned on an upper and a lower [[parts]] portions of the soft magnetic core; and

[[a]] first and [[a]] second coils, each including a plurality of coil lines, formed in such a way that those coils to enclose the soft magnetic core with the soft magnetic core and the insulating film ~~intervened, and having a plurality of coil lines, respectively intervening therebetween,~~

wherein a well of a predetermined [[dept]] depth is formed [[on]] in the semiconductor substrate and the plurality of coil lines constituting the first coil are arranged in an inside of within the well.

18. (Currently Amended) The element ~~according to as claimed in~~ claim 17, wherein a height of the coil lines and a [[dept]] depth of the well are the same.

19. (Currently Amended) The element according to as claimed in claim 17, wherein the first coil is positioned at a lower [[part]] portion of the soft magnetic core and the second coil is positioned at an upper [[part]] portion of the soft magnetic core, and the plurality of coil lines of the first and [[the]] second coils are connected by means of a third coil filled in the filling a via hole formed by passing through the insulating film on both sides of the soft magnetic core.

20. (Currently Amended) The element according to as claimed in claim 17, wherein inner sidewalls of the well has an inclined sidewall that is are gradually inclined in its inside from [[its]] an upper [[part]] portion of the well to [[its]] a bottom of the well.